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Gold King Mine water was headed for the Animas, anyway

The nuts and bolts of acid mine drainage.

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If the media frenzy is any indication, the Upper Gold King Mine blowout of Aug. 5 has become the West's pollution event of the year, maybe even the decade. And in a frenzy there is bound to be confusion, especially when it comes to something as complicated as mine-related pollution.

As the world watched the plume make its way downstream, the reporting on it gained clarity, but errors — most based on a fundamental misunderstanding of the root cause of the "spill" — persist. Most prevalent is the notion that the blowout was a spill of toxic waste, or that the sludge consisted of "toxic chemicals" that miners had added to the mine during the mining process. In fact, the only chemical mining introduced in the Gold King case is, well, oxygen.

While there are a variety of ways that mining can pollute watersheds, the most insidious and persistent is acid mine drainage, which is really a natural phenomenon exacerbated by mining. Acid mine drainage was the root cause of the Gold King blowout, and it plagues tens of thousands of abandoned mines across the West. It's almost impossible to fix, and it lasts forever.

To understand the current problem, it helps to travel into the past. Imagine what the first Anglo settlers saw as they arrived into the San Juan Mountains in the 1860s and 1870s. They drank from any of hundreds of springs, the waters having started out as snowmelt on the mountainsides before finding their way into faults and cracks in the rocks and making the the slow subterranean journey before bubbling from the earth clear and clean (or not, see below). They came upon pristine alpine lakes and crystal clear streams, some of which may have sparkled with the silvery flash of cutthroat trout. In 1889, ichthyologist David Starr Jordan noted, "In the deep and narrow Cañon de las Animas Perdidas (Animas river below Silverton) are many deep pools, said to be full of trout."

But the early settlers also were struck by the reddish orange color (like the Animas River after the "spill") of some of the mountains. They were also struck by the same orange in some streams during times of high runoff, streams that were lifeless even then. Indeed, an observer in 1874 noted that Cement Creek was "so strongly impregnated with mineral ingredients as to be quite unfit for drinking."

Prior to mining, snowmelt and rain seep into natural cracks and fractures, eventually emerging as a freshwater spring (usually).

So now there is acidic water running through the mine. And since the mine follows the metals, so does the water, picking up the likes of zinc, cadmium, silver, copper, manganese, lead, aluminum, nickel and arsenic on the way. The acidic water dissolves these metals, adding them to the solution. After the water pours from the portal (mine opening), it percolates through metal-rich waste rock piled up outside the portal, picking up yet more metals. Next, the water may run through old tailings or leftovers from milling ore and pick up yet more nasty stuff. The soup that eventually reaches the stream is heavily laden with metals and highly acidic. It is acutely and chronically toxic to fish and the bugs they eat.

For long-dead streams like Cement Creek, the added toxicity is meaningless. It's further downstream, in once healthy parts of the river, where the impacts are felt. By the 1970s, the same pools of the Animas River below Silverton that were once "full of trout" were mostly devoid of fish, and the upper stretches of the river were "essentially dead," according to a Colorado Division of Wildlife account from the time.

The Upper Gold King Mine adit had acid mine drainage, then it didn't, then it did. Just as a mine tunnel can intercept ground water flows, so did a new, much larger mine tunnel intercept the water that had, most likely*, been going into the Upper Gold King. In 1959, Standard Metals expanded the American Tunnel below the Upper Gold King to provide new access to the Sunnyside Mine workings. After that, the Upper Gold King tunnel went dry, most likely because the American Tunnel acted as a big drain for all the groundwater in the area. In 1991, Sunnyside Gold Corp. stopped mining at the American Tunnel and began the process of cleaning it up, which included placing multiple bulkheads the size of boxcars in the tunnel over the following decade. Water backed up behind the bulkheads into the vast workings of the mine.

Then, from 2005 on, the Upper Gold King started discharging water at a rate of around 200 gallons per minute. The dynamics of what is happening underground are a subject of debate: It could be that Sunnyside's backed-up acid mine drainage is leaking through cracks and faults into the neighboring mines, a possibility Sunnyside Gold Corp. disputes. It may also be that the natural flow of groundwater, unable to enter the flooded American Tunnel, is returning to its pre-American Tunnel paths.

In 2005 Colorado wildlife officials found trout 16 miles downstream from Silverton. By 2010, the number of fish had dropped dramatically. At Elk Park, the fish were all gone by 2010. The decline was almost certainly due to the cessation of water treatment in upper Cement Creek.

Data from Colorado Parks and Wildlife.

During the last decade, the Upper Gold King has become one of the nastiest polluters around. In 2009, the state mining safety department called it, "arguably one of the worst high quantity, poor water quality draining mines in the State of Colorado." Fish density in the Animas River below Silverton dropped precipitously between 2004 and 2010, most likely the result of new discharge from the Gold King and

neighboring mines and the coinciding cessation of Sunnyside's treatment of water at the American Tunnel and upper Cement Creek. The Gold King's discharge only slowed when the mine tunnel partially collapsed, creating a dam behind which the acid mine drainage backed up. It was this "dam" that burst when the EPA contractor was investigating (having had, they now admit, severely underestimated the amount of pressure built up behind the dam), releasing 3 million gallons of acid mine drainage.

Had the mine roof never collapsed, the water would have reached the stream anyway, albeit more slowly. And had the EPA not messed with the mine, it might have blown out on its own; the EPA, the state, and the mine's owner long worried about the possibility. Such blowouts are not uncommon: The previous year, for example, the Bagley Tunnel in another part of the upper Animas watershed suffered a catastrophic "natural" blowout, at least its second in 20 years.

Now, the Gold King will continue discharging bad water at 200 gallons per minute or more until there's a fix. The tunnel could get its own bulkhead, which could ease the problem by backing water up into the mine and robbing the acid mine drainage-forming reactions of oxygen. But there's a good chance the water would eventually find its way out—and still be polluted.

Currently, the Gold King discharge is running through a series of makeshift lagoons in which flocculent is added to settle out the sludge, along with caustic soda to raise the pH and knock the metals out of solution. A more permanent version of this, strategically placed so it could also clean up discharges from the nearby Red and Bonita and Mogul Mines, two other major polluters, is considered the most feasible fix. But that could cost millions to build and $1 million or more per year to operate. Forever.

There is no overarching "fix" for the upper Animas Watershed, including Superfund. Remember, the Gold King mine is just one of hundreds of abandoned mines in the basin, and one of dozens that are draining nasty water. Besides, there's another major polluter in the region: nature. A nice, clear stream running through a highly mineralized area can trigger the same acid-forming reaction that happens in a mine, and thus become acidic and metal-loaded itself. Even some springs are downright nasty. In 1995, U.S. Geological Survey scientists found at least one natural spring had a pH of 2.9, far more acidic than many of the draining mines in the same area (though with far less discharge). And in one of the sub-basins they studied, natural sources contributed a whopping 82 percent of the total dissolved zinc in the water.

At Howardsville, a few miles upstream from Silverton and the confluence with Cement Creek, the trout population grew significantly. This is evidence that targeted mine remediation can work.

Data from Colorado Parks and Wildlife.

That doesn't let mining, whose impacts are clear and significant, off the hook, but it illustrates the complexity of the problem, and shows why even those who have worked the hardest to address the water problems here pushed back against Superfund designation, particularly in the early days of cleanup. Superfund, or, alternatively, federal disaster money currently being sought by the town of Silverton and San Juan County, may be the best bet for funding an ongoing water treatment facility, but it's not clear how it would apply to an entire watershed, oozing with pollution from so many sources.

Still, 20 years of research and project-by-project remediation under the auspices of the Animas River Stakeholders Group has shown that targeting just the worst polluters can yield significant improvements downstream. The once “essentially dead” reach of the Animas above Silverton now holds over 1,000 fish per mile. If the EPA and Superfund were to build on that work, rather than come in with a pile of cash and brute force and push the locals out of the way, progress is possible. But it won’t come fast, and it won’t come cheap. It took more than 20 years and more than $200 million (and counting, due to ongoing water treatment costs) for Superfund to deal with the Summitville mess on the other side of the San Juan Mountains. And that was just one mine.

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